



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

mammalian teeth, subject only to one of two exceptions; in which exceptions, however, the teeth are small and may readily be distinguished from marsupial by their external character. They are the teeth of the *Hyrax Capensis*, the British Shrews, and the molar teeth of the Jerboa.

The author states, that so far as he has had opportunities of examination, the teeth of the various species may also be distinguished, the one from the other. He points out, for instance, that, on comparison, the teeth of *Dasyurus ursinus* may be distinguished from the *D. macrourus*.

The peculiar characteristic of marsupial teeth exists in the continuation of the dentinal tubes into the enamel; so far as the author has investigated them, he finds but one exception, and that in the Wombat,—the representative of the rodents in the marsupial order. This creature, he finds, has teeth that are nearly allied in structure as well as external form to the teeth of rodents, and more especially to the Hare and Rabbit.

The author states, that he has observed that the dentinal tubes in the human and other teeth are sometimes continued for a short distance into the enamel. This he considers a rudimentary condition which is fully developed in the marsupial teeth. The author observes that the dentinal and enamel pulp become firmly united to each other previous to the commencement of calcification in either, and that it is highly probable that the linear columns of the two pulps are joined end to end, and that the columns of the enamel pulp so joined become developed into tubes instead of into solid enamel fibres. He considers this the more probable, as he has observed that the enamel fibres in an early stage of development are partially tubular in the teeth of several animals whose enamel fibres are ultimately solid.

The teeth described and figured are those of the—

Macropus giganteus.	Petaurus sciureus.
Hypsiprymnus penicillatus.	Dasyurus macrourus.
— minor.	— ursinus.
Phalangista vulpina.	Thylacinus cynocephalus.
Phascolomys Wombat.	Didelphis virginiana.
Petaurus taguanoides.	

The author considers that the facts stated in his paper justify two conclusions of a general character: first, that the existence of prolonged and fully-developed tubes in the enamel, continuous with those of the subjacent dentine, is common to the great majority, if not all, of the marsupial animals, excepting the Wombat; and, secondly, that the enamel and dentine are so closely related, that they should be regarded as modifications of each other, rather than as tissues of a wholly different nature.

10. "On the Motion of Gases."—Part II. By Thomas Graham, F.R.S. &c.

The experiments described by the author in the former paper on the

same subject, afforded grounds for assuming the existence of a relation in the transpirability of different gases, that is, their passage through capillary tubes, of an equally simple nature as that which is recognized among the specific gravities of gases, or even as the still more simple ratios of their combining volumes. Compared with solids and liquids, matter in the form of gas is susceptible of small variation in physical properties, and exhibits only a few grand features. These differences of property, which are preserved amidst the prevailing uniformity of gases, may well be supposed to be among the most deep-seated and fundamental in their nature with which matter is endowed. Under such impressions he has devoted an unusual amount of time and attention to the determination of this class of numerical constants. As the results, too, were entirely novel, and wholly unprovided for in the received view of the gaseous constitution, of which indeed they prove the incompleteness, it was the more necessary to verify every fact with the greatest care.

The most general and simple of the results is, that the transpiration velocity of hydrogen gas is exactly double that of nitrogen gas. These gases, it will be remembered, have a less simple relation in density, namely 1 to 14. This was the conclusion of his former paper respecting the transpiration of these gases, and he has obtained since much new evidence in its favour. The transpirability of carbonic oxide, like the specific gravity of that gas, appears also to be identical with that of nitrogen.

The result which may be placed next in point of accuracy and importance is, that the transpiration velocity of oxygen is related to that of nitrogen in the inverse ratio of the densities of these gases, that is, as 14 to 16. In equal times it is not equal volumes but equal weights of these two gases that are transpired, the more heavy gas being more slowly transpired in proportion to its greater density. Mixtures of oxygen and nitrogen have the mean velocity of these two gases, and hence the time of air is also found to be proportional to its density, when compared with the time of oxygen.

The relation between nitrogen and oxygen is equally precise as that between nitrogen and hydrogen. The densities calculated from the atomic weights of oxygen and nitrogen, namely, 16 and 14, being 1 for oxygen, 0.9010 for air and 0.8750 for nitrogen, the observed times of transpiration of equal volumes of the same gases are for oxygen 1, air 0.8970 to 0.9010, and for nitrogen 0.8708. The result for carbonic acid, which is perhaps next in interest, appears at first anomalous. It is, that the transpiration time of this gas is inversely proportional to its density when compared with oxygen, or 0.7272, the time of oxygen being 1, their velocities will of course be directly as their densities. It is to be remembered, however, that carbonic acid is a compound gas, containing an equal volume of oxygen. The second constituent, carbon, which increases the weight of the gas, appears to give additional velocity to the oxygen in the same manner and to the same extent as increased density from pressure or from cold increases the transpiration velocity of pure oxygen itself. A result of this kind shows at once the important chemical

bearing of gaseous transpirability, and claims for it a place with the doctrines of gaseous densities and combining volumes. The circumstance that the transpiration time of hydrogen is one-half of that of nitrogen, indicates that the relations of transpirability are even more simple in their expression than the relations of density among gases. In support of the same assertion may be adduced the additional fact, that binoxide of nitrogen, although differing in density, has the same transpiration time as nitrogen. Protoxide of nitrogen and carbonic acid have one transpiration time; so have nitrogen and carbonic oxide, as each pair has a common density.

The transpiration of twenty other gases and vapours is experimentally determined, and shown to be uniform, like the preceding gases, with tube resistances varying in amount from 1 to 1000. This list includes protocarburetted hydrogen, olefiant gas, ammonia, cyanogen, hydrocyanic acid, hydrosulphuric acid, bisulphide of carbon, sulphurous acid, sulphuric acid, chlorine, bromine, hydrochloric acid, ether, methylic ether, chloride of methyl, coal-gas and the vapours of water, alcohol and coal-tar naphtha.

The principal results respecting the transpiration of these vapours, and on the influence which pressure and temperature have upon the transpiration of a gas, are summed up as follows:—

The velocity of protocarburetted hydrogen is 0·8, that of hydrogen being 1.

The velocity of chlorine appears to be $1\frac{1}{2}$ that of oxygen; of bromine vapour and sulphuric acid vapour the same as that of oxygen.

Ether vapour appears to have the same velocity as hydrogen gas; their densities are as 37 to 1.

Olefiant gas, ammonia and cyanogen appear to have equal or nearly equal velocities, which approach closely to double the velocity of oxygen.

Hydrosulphuric acid gas and bisulphide of carbon vapour appear to have equal or nearly equal velocities.

The compounds of methyl appear to have a less velocity than the corresponding compounds of ethyl, but to be connected by a certain constant relation.

The resistance of a capillary tube of uniform bore to the passage of any gas is directly proportional to the length of the tube.

The velocity of passage of equal volumes of air of the same temperature, but of different densities or elasticities, is directly proportional to the density. The denser the air, the more rapidly does it pass under a constant propulsive pressure.

Rarefaction by heat has a similar and precisely equal effect in diminishing the velocity of the transpiration of equal volumes of air, as the loss of density and elasticity by diminished pressure has.

A greater resistance in the capillary is required to bring out the law of densities, than appears necessary for the two preceding results; and a resistance still further increased, and the highest of all, to bring out the law of temperatures.

Finally, transpiration is generally promoted by density, and equally whether the increased density be due to compression, to cold, or to

the addition of an element in combination, as the velocity of oxygen is increased, by combining it with carbon without change of volume, in carbonic acid gas.

It did not enter into the plan of the author to investigate the passage of gases through tubes of great diameter, and to solve pneumatic problems of actual occurrence, such as those offered in the distribution of coal-gas by pipes. But he states that the results must be similar, with truly elastic gases such as air and carburetted hydrogen, whether the tubes be capillary or several inches in diameter, provided the length of the tube be not less than 4000 times its diameter, as in the long glass capillaries of his experiments. The small propulsive pressure applied to coal-gas is also favourable to transpiration, as well as the great length of the mains; and he therefore would expect the distribution of coal-gas in cities to exemplify approximately the laws of gaseous transpiration. The velocity of coal-gas should be 1.575, that of air being 1, under the same pressure. And with a constant propulsive pressure in the gasometer, the flow of gas should increase in volume with a rise of the barometer or with a fall in temperature, directly in proportion to the increase of its density from either of these causes.

These laws, it will be observed, are entirely different from those which direct the passage of gases through an aperture in a thin plate, or their flow into a vacuum as it is usually said, and could not be deduced, like the latter, from our speculative ideas respecting the elastic fluids.

11. "On the Automatic Registration of Magnetometers and Meteorological Instruments by Photography."—No. III. By Charles Brooke, M.B., F.R.S.

The author describes the construction of an apparatus for registering the variation of the thermometer and psychrometer on one sheet of paper. As in the apparatus for registering the vertical force magnetometer, described in a former paper, the photographic paper is placed between two concentric cylinders, placed with the axis vertical, and carried round on a revolving plate or turn-table by the hour-hand of a time-piece, which makes half a revolution in twenty-four hours; thus each half of the paper presents a record of the variation of one instrument during twenty-four hours. The scales of the instruments are continuously impressed on the paper by placing fine wires opposite each degree across the aperture through which the light falls on the stem; the light transmitted by the empty bore is intercepted by these wires, and the darkened portion of the paper is marked by a series of parallel pale lines corresponding to each degree: thus the distortion of the scale arising from the varying direction of the pencils of light is corrected. Every tenth degree is marked by a coarser wire, and therefore a broader line, as also the points 32° , 54° , 76° , 98° ; one at least of these points will occur on each register, and the position of the extra broad line serves to identify the part of the scale to which the register relates.

An alteration in the mode of adjusting the wick of the camphine lamps described in a former paper is mentioned, by which the chance